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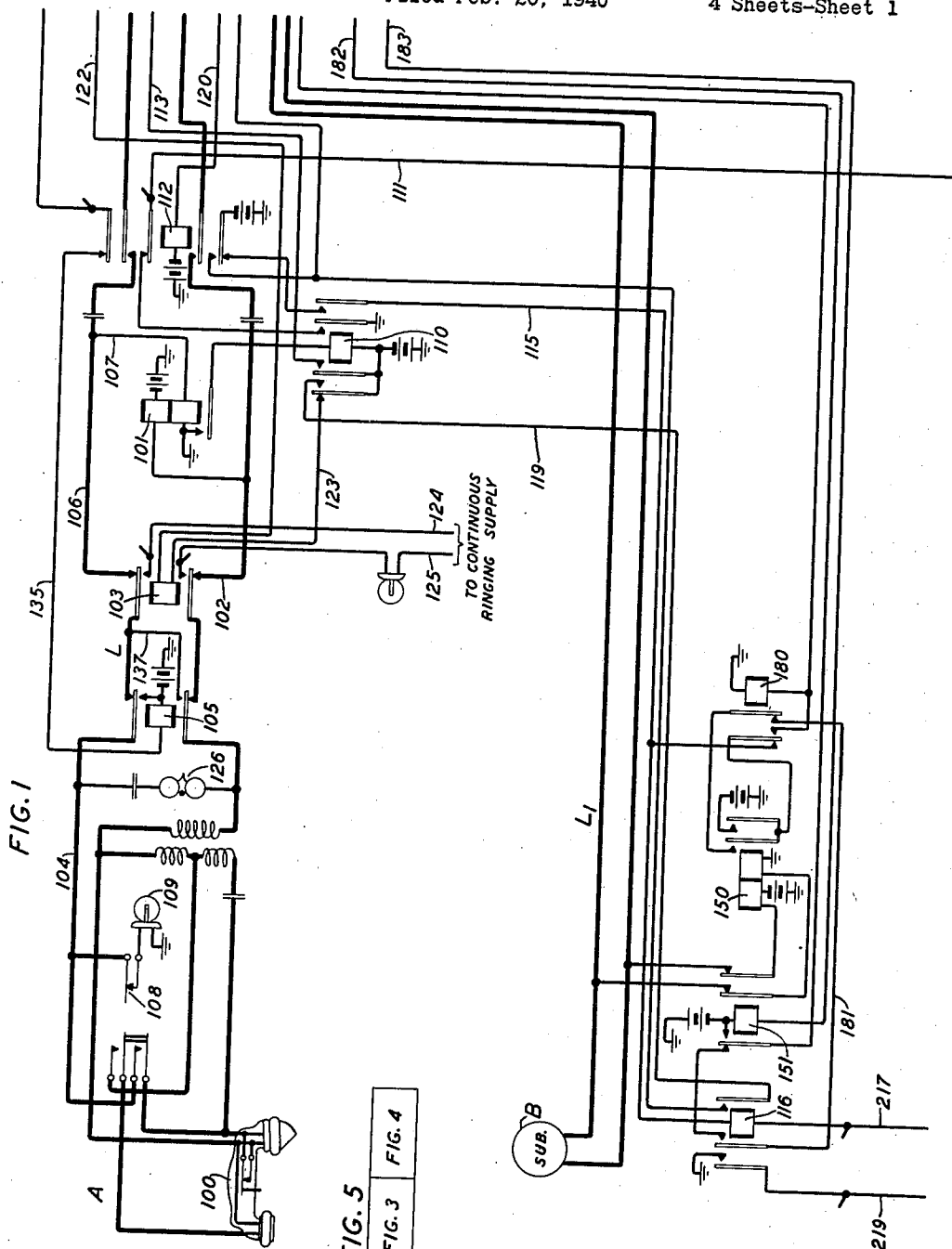
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2,248,040

TELEPHONE SYSTEM

Filed Feb. 20, 1940

4 Sheets-Sheet 1



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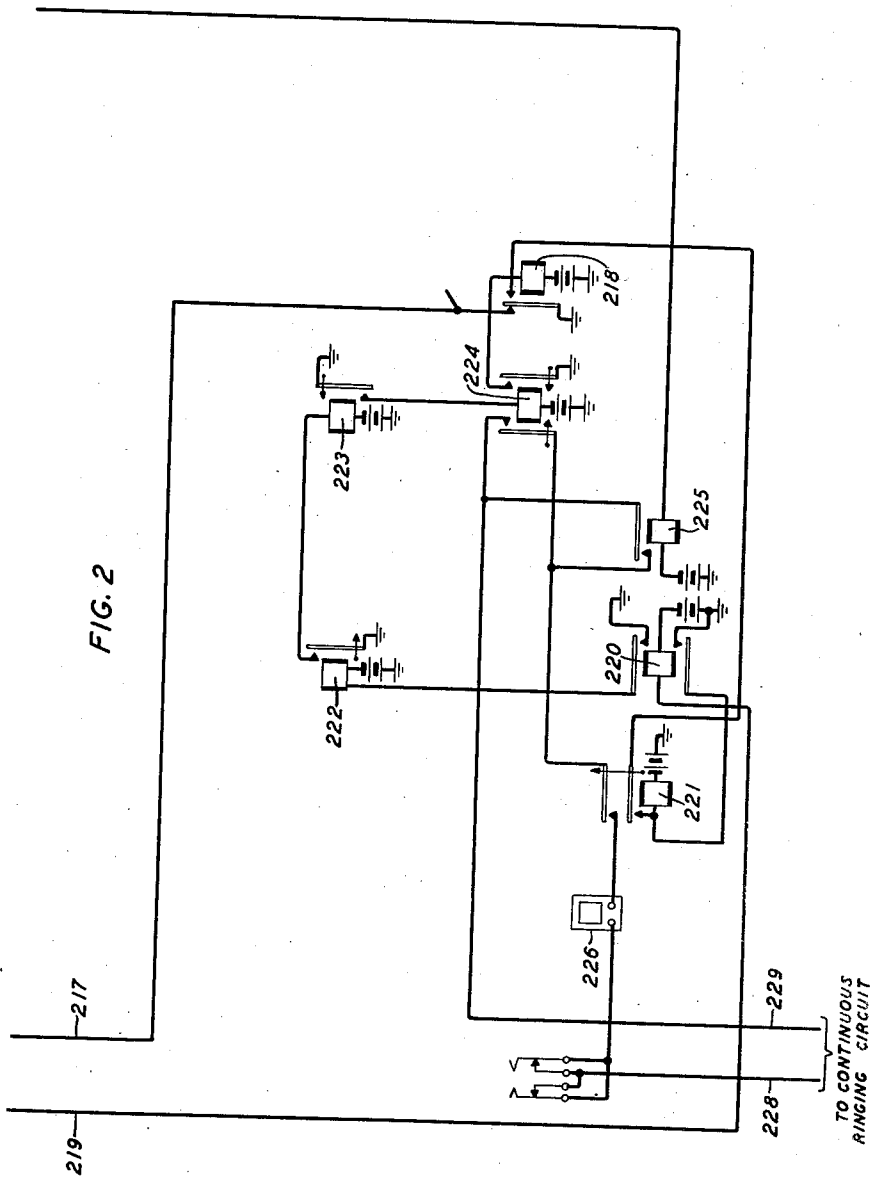
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TELEPHONE SYSTEM

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4 Sheets-Sheet 2



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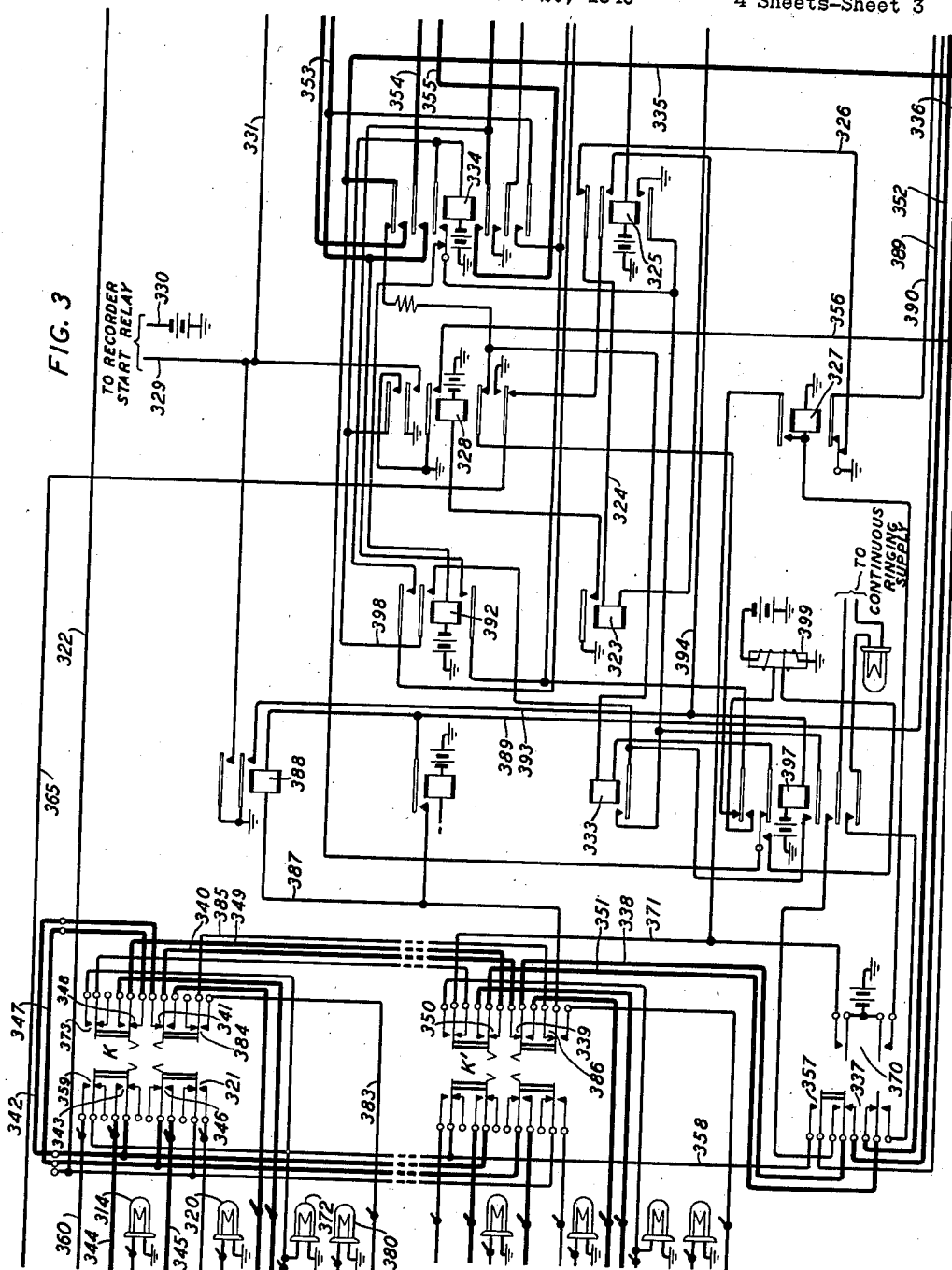
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TELEPHONE SYSTEM

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4 Sheets-Sheet 3



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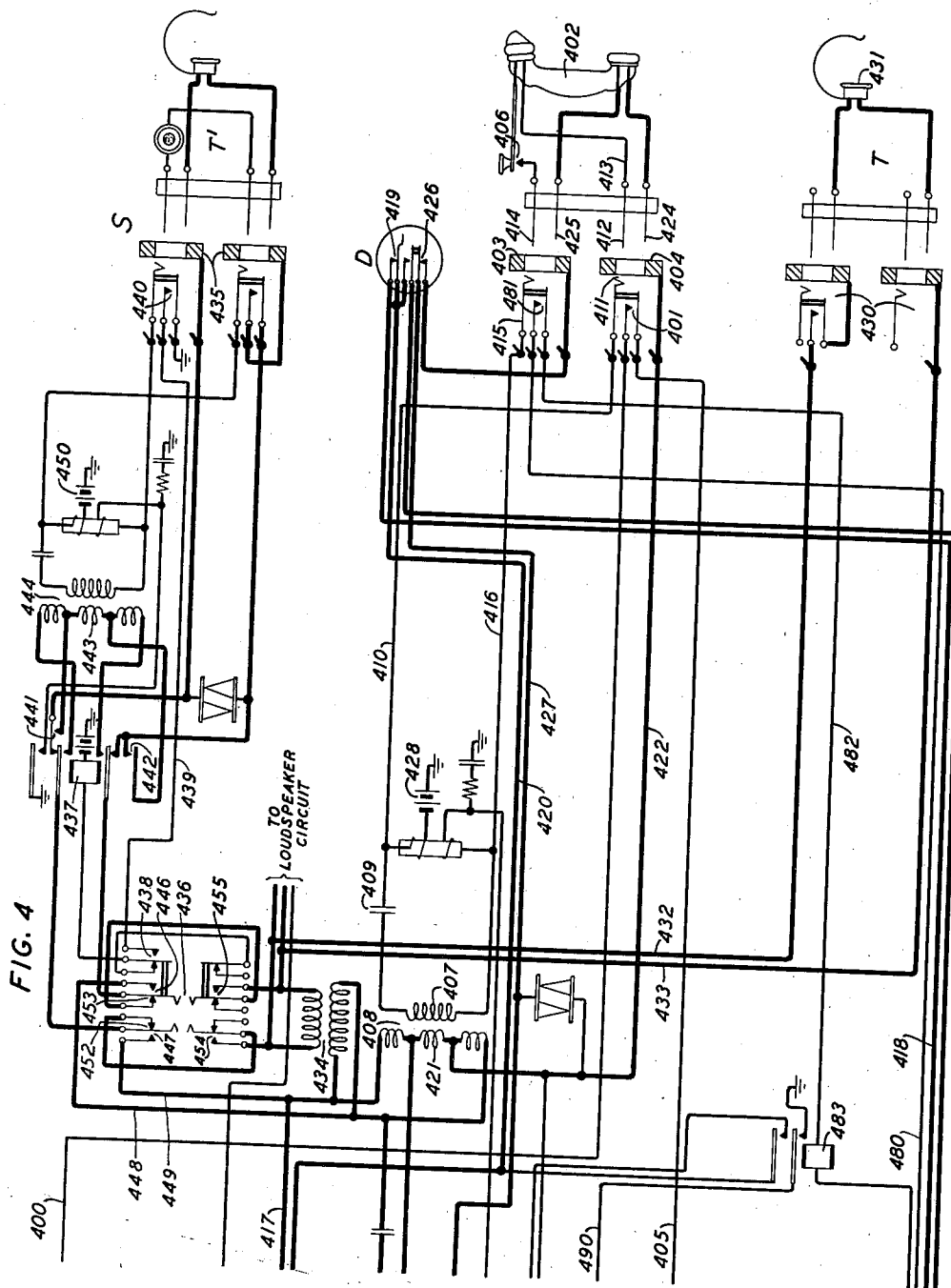
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TELEPHONE SYSTEM

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4 Sheets-Sheet 4



UNITED STATES PATENT OFFICE

2,248,040

TELEPHONE SYSTEM

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Application February 20, 1940, Serial No. 319,350

9 Claims. (Cl. 179—27)

This invention relates to telephone systems and more particularly to telephone systems in which keys are employed at an attendant's position for use in handling calls extended to or originated at substations, central offices, and the like.

It is the object of this invention to provide an improved type of key equipment and associated circuits which render it possible for an attendant to answer calls from, and originate calls to subscribers' stations, central offices, and the like.

In accordance with a particular feature of the invention a subscriber's station located on a key equipment line which is designed to provide conference facilities, is provided with a visual signal which functions, when an attendant at whose position the line terminates is busy handling a connection on another line, to indicate to the subscriber that the attendant is busy and not immediately available to receive a call originated at the subscriber's station. More specifically, when an attendant actuates a key which functions to connect his telephone equipment with a particular line circuit, a relay in the key equipment conference line functions to effect the lighting of a busy lamp at the conference station, or stations, associated with the key equipment line or lines, to indicate to the subscribers thereat that the attendant is busy and not available to receive calls originating at the conference stations.

A related feature contemplates the provision of means whereby a subscriber on a key equipment line circuit of the conference type is not isolated from the attendant's position when the attendant is busy in handling other calls as indicated by the lighted condition of the busy lamp signal at the subscriber's station. This feature is particularly desirable in that, in the event of an emergency, the subscriber may utilize the regular line circuit equipment and follow the same procedure in initiating a regular call to attract the attention of the attendant, though the latter is, at that time, engaged on another connection. This feature is made possible by the provision of means which functions, not only to light the busy lamp at the conference station, but also to prepare an auxiliary energizing circuit for the subscriber's line relay so that, should the subscriber find it necessary to signal the busy attendant, he may do so by removing his receiver from its switchhook to complete the auxiliary circuit and cause a line signal to be displayed at the attendant's position.

These and other features of the invention will be readily understood from the following detailed

description made with reference to the accompanying drawings in which:

Fig. 1 illustrates diagrammatically two types of line circuits, a conference line L and a non-conference line L₁, over which calls to and from the subscribers' stations A and B, respectively, may be originated and received at an attendant's position;

Fig. 2 is a diagrammatic representation of the common signaling circuit which functions with the lines L and L₁;

Fig. 3 is a diagrammatic representation of the attendant's key equipment and associated circuits;

Fig. 4 illustrates an attendant's and a supervisor's telephone equipment, and a key for associating the latter with the attendant's key equipments for monitoring and supervisory purposes; and

Fig. 5 is a block diagram illustrating the manner in which Figs. 1, 2, 3 and 4 are to be associated in order to effect a complete system.

The following description is directed to the operation of the system on a call originating at station A associated with the line L, which is arranged for conference service.

When the handset 100 at station A is removed from its mounting, line relay 101 operates in a circuit extending from grounded battery, upper winding of relay 101, conductor 102, back contacts and lower armatures of relays 103 and 105, through the subscriber's station loop, now closed at the handset mounting contacts, conductor 104, upper armatures and back contacts of relays 105 and 103, conductors 106 and 107 to ground through the lower winding of relay 101. When the handset 100 is removed from its mounting the contact 108 is opened, thus opening the connection to the busy lamp 109 at station A.

Relay 101 in operating, establishes an obvious operating circuit for relay 110. At its inner right armature, relay 110 connects ground to the lead 111 by way of the back contact and innermost upper armature of relay 112. At its outer left armature, relay 110 removes battery from the winding of relay 103 to prevent this relay from operating in case the attendant signals other conference line stations while connected to this line. At its inner left armature, relay 110 connects battery to conductor 113 which causes the supervisory lamp 314 at the attendant's position to be lighted. At its outer right armature, relay 110 completes a circuit from grounded battery, armature and outer lower armature of relay 112, front contact and outer right armature

of relay 110, conductor 115, winding of flashing relay 116, conductor 217 (Fig. 2), to ground by way of the back contact and armature of relay 218. At its outer left armature and front contact, relay 110 connects battery to conductor 119, which extends to the right armature of flashing relay 116, for lighting the line and busy lamps 320 at the key box at the attendant's position.

Relay 116, operating in the circuit previously traced, connects ground to its outer left armature by way of its associated front contact and thence over conductor 219, to battery and ground through the winding of start relay 220.

Relay 220 operated, causes relays 221 and 222 to operate in obvious circuits. At its inner upper armature, relay 221 prepares a locking circuit for itself to the front contact of relay 218, and at its upper armature and front contact partially closes an auxiliary signal circuit.

Relay 222 operated, completes an obvious circuit for relay 223, which relay operates and in turn establishes an obvious operating circuit for relay 224. Relay 224, which is slow to release, operates relay 218. Relay 218 opens the lead 217 and similar leads to other line circuits and closes the holding circuit for relay 221.

The opening of the lead 217 and other similar leads, releases relay 116 which had previously connected ground to the start lead 219. Relay 220, accordingly releases and in turn releases relays 222, 223, 224 and 218. When relay 218 releases, ground is again connected to the lead 217 to the line circuit which will again cause relay 116 to operate and to again connect ground to the start lead 219. Relay 221 is slow to release and holds operated during the time relay 218 releases until relay 116 and relay 220 reoperate. Relays 220, 222, 223, 224 and 218 again reoperate and release and continue to do so until the call is answered by the attendant. As a result of the repeated operations and releases of relay 116, the line and busy lamp 320 at the key box at the attendant's position is caused to flash to indicate an incoming call on the line associated with the key K at the attendant's position.

As the line on which station A is located is a conference line, relay 225 will operate when ground is connected to the conductor 111 by the operation of relay 110 as previously described. Relay 225 operated, causes the buzzer 226 to operate steadily on current from the continuous ringing source connected to the leads 228 and 229. If the call is on other than a conference line, the buzzer 226 will function intermittently when relays 222 and 224 operate as will be described more fully hereinafter.

When the attendant answers by operating the line key K in the key box associated with the line upon which station A is located, relay 112 operates in a circuit extending from grounded battery, winding of relay 112, conductor 120, contacts 321 of key K, conductor 322, conductor 400, closed jack contacts 401 (it being understood that the attendant's telephone set 402 will be plugged into the jacks 403 and 404 by means of the associated plugs), conductor 405, winding of relay 323, conductor 324, outer upper armature and back contact of relay 325, conductor 326 to ground at the normally closed lower contacts of relay 327.

Relay 112 operated, removes battery at its outer lower armature from the lead 115 which causes relay 116 to release, and connects this battery to its front contact to cause the line and busy lamp 320 to operate steadily as a busy indication.

At its innermost upper armature, relay 112 opens the circuit to relay 225 which, in restoring its armature silences the buzzer 226. At its outermost upper armature, relay 112 opens the circuit to relay 105 and at its middle upper and inner lower armatures closes the tip and ring leads of the calling line to the attendant's telephone and key circuit.

When the key K was operated, a circuit for relay 112 was completed as above described. This circuit includes the winding of relay 323 so that this relay also operates. The plug of the attendant's telephone set 402 must be in the talk jacks 403 and 404 as hereinbefore mentioned, and all keys other than the conference keys must be normal, otherwise the circuit for operating relay 323 is open. Two or more conference keys may be operated at one time.

Relay 323 operated, causes relay 328 to operate in an obvious circuit which starts the voice recorder (not shown, but controlled over conductors 329 and 330) to function; connects ground to lead 331 for lighting busy lamps at the loud-speaker, not shown, and connects ground to the lead 332, 365 to provide for the lighting of the busy lamps, such as lamp 109, at the conference stations, in a manner to be more fully described hereinafter. At its inner lower armature relay 328 opens the circuit to relay 333 to prevent this relay from operating at this time, and at its outermost upper armature establishes an obvious circuit for relay 334.

Relay 334 operates and closes the transmitter and receiver circuits of the attendant's handset 402. The transmitter of handset 402 is connected across the winding 407 of repeating coil 408 in the following circuit; starting with the upper terminal of winding 407, thence through condenser 409, conductor 410, jack spring 411, plug contact 412, conductor 413, the transmitter of handset 402, contacts of key 406 (closed for talking purposes) plug contact 414, jack spring 415, conductor 416 to the lower terminal of repeating coil winding 407. The remainder of the attendant's speech transmitting path extends from the upper left-hand terminal of repeating coil 408, conductor 417, front contact and outermost upper armature of relay 334, conductor 335, conductor 336, upper normally closed contacts of "Flash and Ring" key 337, conductor 338, normally closed contacts 339 of the attendant's key K', through corresponding contacts of other keys in the attendant's key box, conductor 340, normal contacts 341 of key K, conductor 342, closed contacts 343 of key K, tip conductor 344, inner lower armature and front contact of relay 112, back contacts and lower armatures of relays 103 and 105, through the subscriber's substation circuit, upper armatures and back contacts of relays 105 and 103, conductor 106, front contact and middle upper armature of relay 112, ring conductor 345, closed contacts 346 of key K, conductor 347, contacts 348 of key K, conductor 349, through the intermediate keys of the attendant's key set, contacts 350 of key K', conductor 351, lower normally closed contacts of key 337, conductor 352, conductor 418, contacts 419 of dial D, conductor 420, conductor 353, front contact and middle upper armature of relay 334, conductor 354 to the lower left terminal of repeating coil 408.

The attendant's handset receiver circuit is connected across the winding 421 of coil 408 in a circuit extending from the lower terminal of this winding, conductor 422, sleeve contacts of

jack 404 and the corresponding plug contact 424, through the receiver of the attendant's handset 402, plug contact 425, sleeve spring of jack 403, contacts 426 of dial D, conductor 427, innermost lower armature and front contact of relay 334, conductor 355 to the upper terminal of winding 421 of repeating coil 408. Talking current is supplied by the battery 428.

The subscriber at station A and the attendant may now carry on conversation.

On an outgoing call, that is, a call from the attendant's position to the conference line subscriber at station A, the key K is actuated as in the previous case and the same circuit functions are performed. The attendant then actuates the "flash and ring" key 337, whereupon a circuit is established extending from ground, innermost upper armature and front contact of relay 328, conductor 356, contacts 357 of key 337, conductor 358, contacts 359 of key K, conductor 360, conductor 122, winding of relay 103, conductor 123 to grounded battery by way of the back contact and outer left armature of relay 110. Relay 103 operates in this circuit, interrupts the continuity of the tip and ring conductors of the subscriber's line and connects a continuous ringing supply to the station A by way of the conductors 124 and 125. Current from this source actuates the ringer 126 which is bridged across the line. In response to the operation of the ringer 126, the subscriber at station A removes the handset 100 from its cradle support which causes the operation of relays 101 and 110 as described hereinbefore.

Besides the functions hereinbefore mentioned, relay 110, at its back contact and outer left armature opens the circuit to relay 103 which causes this relay to restore its armatures. The tip and ring conductors of the subscriber's line are thus again rendered continuous and the continuous ringing supply is disconnected from the called station.

At the termination of a call on the subscriber's line the key K is restored to normal and all operated relays restore to normal.

If it is desirable for a supervisor to listen in on line connections to the attendant's position she may do so by plugging the listening set T into the listen jacks 430. When this is done, the receiver 431 is connected across the conductors 432 and 433 which are connected across the upper winding of coil 434, the lower winding of which is bridged across the left windings of induction coil 408. Thus the supervisor may listen in on an established connection.

S indicates a supervisor's position from which the supervisor may listen in and talk on connections by using a telephone set T' and plugging it into the "talk or listen" jacks 435. A key 436 individual to the attendant's position shown in Fig. 3 is illustrated at the upper left of Fig. 4 and may be actuated to either a "talk" or "listen" position. When actuated to the "talk" position the upper contact springs are actuated while the lower set of springs is actuated when the key is actuated to the "listen" position.

Assuming the supervisor's telephone set T' has been associated with the jacks 435 and that the key 436 has been actuated to the "listen" position, the receiver of the set T' is effectively connected across the upper winding of coil 434, by way of the plug and jack receiver contacts, back contacts and inner upper and lower armatures of relay 437, normal contacts 452 and 453 of the upper portion of key 436 and alternate contacts 454

and 455 of the lower portion of key 436. The lower winding of coil 434 is connected across the outer terminals of the repeating coil 408 which is effectively included in the established connection. In this manner, the supervisor may listen in.

In order to talk on the established connection the supervisor actuates the key 436 to the "talk" position so as to actuate the upper springs of the key. Relay 437 is thus operated in a circuit extending from grounded battery, winding of relay 437, contacts 438 of key 436, conductor 439 to ground by way of the jack contacts 440. The transmitter of the telephone set T' is now connected directly across the right winding of coil 444 whose left windings are now connected across the outer left terminals of repeating coil 408 by way of the front contacts and inner armatures of relay 437, contacts 446 and 447 of key 436 and conductors 448 and 449. In this manner the supervisor may talk on an established connection, the battery 450 supplying the necessary transmitter current.

It will be observed that when the key 436 is actuated to the "talk" position, the receiver of the supervisor's telephone set T' is connected across winding 444 of the coil 443 so that the supervisor may listen as well as talk on the connection whereas, when the key 436 is actuated to the "listen" position the supervisor's transmitter circuit is on open circuit at the front contacts and inner upper and lower armatures of relay 437.

The foregoing description covers the operation of the disclosed system on a call originating on a line L arranged for conference service, and extended to the attendant's position and on a call to a conference line, such as line L from the attendant. It also covers the lighting of the busy lamp 109 at the conference line station A when the attendant is busy handling a call on another line. The description also covers the operation of the supervisor's equipment whereby a supervisor may listen in on a particular connection at a particular attendant's position by plugging the receiver 431 into the jacks 430 located at the particular attendant's position and may talk and listen on any connection at any of the attendants' positions by plugging the telephone set T' into the jacks 435, it being understood that, at the supervisor's positions there is provided a plurality of keys, such as key 436, one for each attendant's position.

In the operation of relay 328 above described, it was indicated that a recorder was started operating when ground was connected to the conductor 329. This feature is provided because it has been found desirable, when reviewing the operations of a traffic control office after a period of heavy traffic or after an emergency, to have a complete record of all transactions which took place between the control office and other points concerned. A voice recorder is accordingly provided for each key equipment position in the control office. Whenever an attendant is busy on any line associated with his position other than central office or private branch exchange lines, his position circuit connects monitoring taps to the voice recorder (not shown) and by means of a relay such as relay 328, starts the voice recorder motor so that a phonograph record of all conversations involving the attendant and the other intercommunicating points is secured.

The following description is directed to the

operation of the disclosed system on calls originated on and extended to lines other than those which are arranged for conference service. For this purpose there is shown on the lower portion of Fig. 1 an automatic line L_1 on which is located the key equipment station B.

When the receiver at the station B is removed from the switchhook, relay 150 operates in a circuit which includes the right armatures and back contacts of relay 151 and the closed line loop at station B. At its outer right armature, relay 150 completes a circuit for the flashing relay 116 which may be traced from grounded battery, outer armature and front contact of relay 150, outer armature and back contact of relay 180, winding of relay 116, conductor 217 to ground by way of the back contact and armature of relay 218. At its inner armature and front contact relay 150 extends battery to the inner left armature of flashing relay 116 by way of the inner armature and back contact of relay 180 and conductor 181. The front contact of relay 116, to which battery has been connected by the operation of relay 150, controls the operation of the line and busy lamp 380, being connected to the filament thereof by way of the back contact and left armature of relay 151, and conductor 182.

At its outer left armature relay 116 connects ground to the "start" lead 219 to cause the operation of "start" relay 220. Relay 220 starts the flashing circuit to function in a manner previously described to cause the intermittent operation and release of flashing relay 116 which causes the lamp 380 at the attendant's position to flash indicating the incoming call on line L_1 . It will be noted that relay 225, which is common to conference lines only, does not operate on a call originating on the non-conference line L_1 so that the buzzer 226 will operate intermittently under control of relay 224 as a distinctive audible signal.

When the attendant answers by operating the line key K in the key box to the right, relay 151 operates in a circuit extending from grounded battery, winding of relay 151, conductors 183 and 383, contacts 384 of key K, conductor 385, contacts 386 of key K', conductor 387, winding of relay 388, conductor 389, conductor 480, contacts 481 of jack 403, conductor 482, winding of relay 483, conductor 390 to ground at the lower normally closed contacts of relay 327. Relays 151, 388 and 483 operate in this circuit.

Relay 151 operated, opens the energizing circuit for relay 150 which relay releases. At its left armature and front contact, relay 151 causes the line and busy lamp 380 to be lighted steadily by connecting battery directly to conductor 182. Relay 150 opens the circuit to flashing relay 116 which relay restores its armatures.

Relay 483 at its inner armature and front contact, establishes an obvious energizing circuit, by way of conductor 490, for relay 325. At its lower armature, relay 325 establishes an energizing circuit for relay 392 by way of the closed make-before-break contacts of relay 334. At its outer upper armature, relay 325 opens the circuit to relay 323 and at its inner upper armature, completes a circuit extending from ground, inner armature and front contact of relay 388, conductors 393 and 394, front contact and inner upper armature of relay 325, back contact and outer lower armature of relay 328, conductor 365, outermost upper armature and back con-

tact of relay 112, conductor 135, winding of relay 105 to battery and ground. Relay 105 operating in this circuit opens the tip and ring conductors of the conference lines such as line L and causes the busy lamp 109 at the stations, such as station A to be lighted. Relay 105, as in the previous description prepares the line relay 101 for operation in an emergency.

At its outer armature, relay 388 connects ground to conductor 329 to start the voice recorder operating as in the previous case. It also connects ground to lead 331 to light a busy lamp (not shown) at the loud-speaker (not shown) when two or more loud-speakers are located at one point to indicate which loud-speaker the conversation is being reproduced on. Relay 388 also establishes an obvious circuit for relay 397.

With relays 392 and 397 operated, relay 334 operates in a circuit extending from grounded battery, winding of relay 334, conductor 398, inner armature and front contact of relay 392, front contact and innermost lower armature of relay 397, to ground at the lower armature and front contact of relay 325. Relay 334 operated, locks to ground under control of relay 325.

Relay 334 closes the transmitter and receiver circuits of the attendant's telephone set 402, releases relay 392 and connects the retard coil 399 and its associated battery across the conductors 353 and 417. Relay 392 released, opens the operating circuit to relay 334 which is now locked under control of relay 325.

Relay 397 at its two outer lower armatures and front contacts connects the contacts of the flash and ring key 337 to a continuous ringing supply.

With the operation of relay 334 the circuit is placed in condition for talking.

If the call is to be held, the holding key 370 is operated which connects battery to the "hold" lead 371 which causes the lighting of "hold" lamp 372 in the key box at the attendant's position. The circuit for this lamp includes the uppermost normally closed contacts of key K1, corresponding contacts of intermediate keys (not shown) and contacts 373 of key K. Relay 327 also operates, when the "hold" key 370 is actuated, and locks over lead 371 and remains locked until the line key K is released. Relay 327, operated, releases relays 483, 388 and 151.

When relay 151 releases its armatures, relay 150 is again connected across the line L_1 , and re-operated over the substation loop. Relay 180 which operated in parallel with the "hold" lamp 502 when key 370 was actuated, is now held operated to battery at the outer armature and front contact of relay 150. Relay 180, operated, prevents relay 116 from operating and the line and busy lamp 380 from lighting.

In the above description of the operation of the system on a call originating on line L_1 , the operation of relay 323, is indicated and reference made to the fact that, under this condition, relay 105 in the line circuit L operates in the circuit hereinbefore traced. It is to be understood that the conductor 365 is common to all conference lines such as line L so that relay 105 and all similar relays individual to other conference lines will be operated. Relay 105 operated, establishes a circuit for busy lamp 109 which circuit includes the normal switchhook contacts 108 and the upper armature and front contact of relay 105. The lamp 109 at station A, and all similar lamps at the other conference stations are thus lighted to indicate to the sub-

scribers thereat that the attendant is busy handling another call and is not available to answer calls initiated at the station at which the lamp 109 or similar lamp signals are actuated.

At their lower armatures, all relays such as relay 105 connect the tip conductors of their respective lines extending from the attendant's position, to the ring leads at the substations. This is done for a purpose which will be indicated presently.

Though the subscriber at a conference station, such as station A, upon noting the lighted condition of the lamp 109 would not, under ordinary circumstances attempt to initiate a call to the attendant, conditions of emergency may arise when it becomes necessary for a call to be put through to the attendant even when it is known that the latter is busy handling another call. In such an event the subscriber at a station, such as station A, would remove the handset 100 from its cradle support as in the case of a regular call, that is, during the time when the lamp 109 is not lighted. Upon such action by the subscriber at station A, line relay 101 operates in a circuit extending from grounded battery, front contact and upper armature of relay 105, through the subscriber's station circuit, lower armature and front contact of relay 105, conductor 137, upper armature and back contact of relay 103, tip lead 106, conductor 107 to ground by way of the lower winding of relay 101. It will be noted that the circuit to the upper winding of relay 101 is, at this time, open at the lower armature of relay 105. Relay 101 causes relay 110 to operate in an obvious circuit and to perform the same functions it did in the case of a regular call from station A, as previously described. One of these functions is to cause the lamp 314 at the attendant's position to be lighted as an emergency signal. Upon receipt of such a lamp signal when occupied in handling another call, the attendant would give preference to the emergency call and proceed to answer it by actuating key K to the left position.

It is to be understood that the emergency feature just described is provided also when the attendant is busy handling a call on a conference line as well as on a non-conference line such as line L1. It was pointed out in the description having to do with a call originated at station A, that relay 328 operated and connected ground to conductor 365, which conductor is common to all the conference lines. This ground causes the operation of all other conference line relays 105 which, as indicated above, causes the station lamps, such as 109 to be lighted and an auxiliary operating circuit for their corresponding line relays, such as 101, to be prepared. This auxiliary operating circuit for the line relays of the conference lines renders it possible for subscribers at the conference stations to signal the attendant in an emergency even though they are advised by the lighted lamps 109, etc., that the attendant is busy.

The telephone system described above is particularly suitable for use in airways traffic control offices located in control centers of large airports. It is obvious, however, that it is not limited in its usefulness to this particular application.

What is claimed is:

1. In a telephone system, a plurality of switching keys located at an attendant's position, a line circuit terminating in the contacts of one of said keys and having a station thereon, a visual signal

at said station, a second line circuit terminating in the contacts of another of said keys, and means responsive to the actuation of the key associated with said second line circuit for energizing the visual signal at the station of said first line circuit.

2. In a telephone system, a plurality of switching keys located at an attendant's position, a line circuit terminating in the contacts of one of said keys and having a station thereon equipped with a telephone handset and a visual signal device, a second line circuit terminating in the contacts of another of said keys, means responsive to the actuation of the key associated with said second circuit for energizing the visual signal at the station of said first line, and means controlled by the handset thereat for deenergizing said signal device.

3. In a telephone system, a plurality of switching keys located at an attendant's position, a line circuit terminating in the contacts of one of said keys at said attendant's position and having a station thereon, a visual signal at said station, a second line circuit terminating in the contacts of another of said keys, a relay in said first line circuit responsive to the operation of the key associated with said second line circuit, and means controlled thereby for completing an energizing circuit for said visual signal.

4. In a telephone system a plurality of switching keys located at an attendant's position, a line circuit terminating in the contacts of one of the keys at said attendant's position and having a subscriber's station thereon, a visual signal at said station, a second line circuit terminating in the contacts of another of said keys, a relay in said first line circuit responsive to the operation of the key associated with said second line circuit, means controlled by said relay for completing an energizing circuit for said visual signal, and means responsive to the removal of the receiver at said subscriber's station for interrupting the energizing circuit for said visual signal.

5. In a telephone system, a line circuit extending from a subscriber's station to an attendant's position, a signal device at the attendant's position, a switching device at the attendant's position, a line relay controlling the operation of said signal device, means responsive to the removal of the receiver from its support at said station for energizing said line relay by way of the tip and ring conductors of said line circuit, and means controlled by said switching means and rendered effective by the removal of the receiver from its support subsequently to the actuation of said switching means for energizing said relay by way of the tip conductor only of said line circuit.

6. In a telephone system, a subscriber's station, an attendant's position, a telephone associated with the substation circuit at said subscriber's station, a line circuit extending from the substation circuit to said attendant's position and comprising tip and ring conductors, a line relay, means responsive to the removal of said telephone from its support at said subscriber's station for completing an energizing circuit for said relay including the tip and ring conductors of said line circuit, a switching device at said attendant's position, and means controlled thereby for preparing an energizing circuit for said relay which includes but one of said line circuit conductors.

7. In a telephone system, a subscriber's station, an attendant's position, a telephone associated with the substation circuit at said subscriber's station, a line circuit extending from the sub-

station circuit to said attendant's position and comprising tip and ring conductors, a two-winding line relay, means responsive to the removal of the telephone from its support at said subscriber's station for completing an energizing circuit for said relay including the tip and ring conductors of said line circuit and both windings of said relay, a switching device at said attendant's position, and means controlled thereby for preparing an energizing circuit for said relay including the tip conductor of said line circuit and but one of the windings of said relay.

8. In a telephone system, a line circuit extending between a subscriber's station and an attendant's key switching position, a two-winding line relay for said line circuit, a normal energizing circuit for said relay which includes both of its windings and is completed when the subscriber at said station removes the receiver thereat from its switchhook, an auxiliary energizing circuit for said line relay which includes but one of its windings, switching means at the attendant's position, and means controlled thereby for rendering the auxiliary energizing circuit effective in operating said relay when the subscriber at said station removes the receiver from its switchhook.

9. In a telephone system, a subscriber's station, an attendant's position, a telephone associated

with the substation circuit at said subscriber's station, a line circuit extending from the substation circuit to said attendant's position and comprising tip and ring conductors, a two-winding line relay having one winding connected between ground and the tip conductors of said line circuit and the other winding connected between battery and the ring conductor of said line circuit, whereby said relay operates by way of both its windings and the tip and ring conductors of said line circuit when the telephone at said subscriber's station is removed from its support to close the substation circuit, switching means at said attendant's position, and means controlled thereby for opening the ring conductor of said line circuit, connecting the tip lead of said line circuit to the ring lead of the substation circuit and connecting a battery source to the tip lead of the substation circuit whereby said relay is energized over a circuit including only the tip conductor of said line circuit and the winding of said relay connected between ground and the tip conductor of the line circuit, when the telephone at said substation is removed from its support subsequently to the operation of said switching means.

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